REMARKS

In response to the Office Action dated April 10, 2008, claims 1, 10, 11, 19, 20, and 28 have been amended and claims 5-7, 9, 15, 18, 27, 29, and 31 have been canceled. Therefore, claims 1-4, 8, 10-14, 16, 17, 19-26, 28, and 30 are now in the case. In light of the amendments and arguments set forth herein, reexamination and reconsideration of the application are requested.

Section 101 Rejections

The Office Action rejected claims 10, 19, 20-26, 28, and 30 under 35 U.S.C. § 101 because the claimed invention is directed to non-statutory subject matter.

In response to the rejections of claims 10 and 19, the Applicants have amended claims 10 and 19 to recite a computer-readable medium that has stored and encoded thereon functional descriptive material. Further, amended claims 10 and 19 recite structural and functional interrelationships between a computing device and a computer-readable medium that permits the computer-readable medium's functionality to be realized. This is statutory subject matter.

In response to the rejections of claims 20-26, the Applicants have amended claim 20 to recite a computer-implemented process that is stored and encoded on a computer-readable storage medium for rendering graphics on an embedded device. Further, amended claim 20 recites structural and functional interrelationships between a computing device (the embedded device) and a computer-readable medium that permits the computer-readable medium's functionality to be realized. Again, this is statutory subject matter.

The MPEP §2106.01 states that "[W[hen functional descriptive material is recorded on some computer-readable medium, it becomes structurally and functionally interrelated to the medium and will be statutory in most cases since use of technology permits the function of the descriptive material to be realized." The Applicants have amended claims 10, 19, and 20 to recite functional descriptive material that is stored

and encoded on a computer-readable storage medium. Again, this is statutory subject matter.

Accordingly, the Applicants respectfully submit that amended claims 10, 19, and 20 are patentable under 35 U.S.C. § 101 based on the amendments to claim 10, 19, and 20, and the legal and technical arguments set forth above and below. Moreover, claims 21-26 depend from amended independent claim 20 and thus also contain patentable subject matter (MPEP § 2143.03). The Applicants, therefore, respectfully request reexamination, reconsideration and withdrawal of the rejection of claims 10, 19, and 20-26 under 35 U.S.C. § 101.

In response to the rejection of claims 28 and 30, the Applicants have amended independent claim 28 to now recite an embedded computing device and a computer-readable storage medium having stored and encoded thereon a computer program that contains program modules having computer-executable instructions that are executable on the computing device. The Applicants are not claiming a computer program *per se*, but a system that includes a computer program, but that is nevertheless statutory.

Specifically, as stated in the MPEP (see Section 2106 (IV)(B)(1)(a) at Page 2100-13, Rev. 2, May 2004):

> "Computer programs are often recited as part of a claim. Office personnel should determine whether the computer program is being claimed as part of an otherwise statutory manufacture or machine. In such a case, the claim remains statutory irrespective of the fact that a computer program is included in the claim. **The same result occurs when a computer program is used in a computerized process where the computer executes the instructions set forth in the computer program.**"

Accordingly, the Applicants respectfully submit that amended independent claim 28 is patentable under 35 U.S.C. § 101 based on the amendment to claim 28, and the legal and technical arguments set forth above and below. Moreover, claim 30 depends from amended independent claim 28, and thus also contain patentable subject matter (MPEP § 2143.03). The Applicants, therefore, respectfully request reexamination, reconsideration and withdrawal of the rejection of claims 28 and 30 under 35 U.S.C. § 101.

<u>Section 102(b) Rejections</u>

The Office Action rejected claims 11, 12, and 19 under 35 U.S.C. § 102(b) as being anticipated by Narayanaswami (U.S. Patent No. 5,555,355). The Office Action stated that Narayanaswami discloses each and every element or feature recited by the Applicants' claims. In response, the Applicants respectfully traverse these rejections based on the amendments to claim 11, and the following legal and technical analysis.

In particular, the Applicants submit that Narayanaswami is missing several features recited by the Applicants' claims. In particular, Narayanaswami do not disclose, either explicitly or implicitly, the material claimed feature of:

1.　　**(Regarding amended independent claim 11)**: "<u>converting the vertices</u> in the floating-point format <u>into a normalized homogeneous coordinate system (NHCS) fixed-point format</u>".

<u>Amended Independent Claim 11</u>

Amended independent claim 11 of the Applicants claimed invention includes a process for transforming and lighting rendering data. The process includes inputting rendering data in model space containing vertices in a floating-point format, and <u>converting the vertices</u> in the floating-point format <u>into a normalized homogeneous coordinate system (NHCS) fixed-point format</u>. The process also includes transforming vertices in a NHCS fixed-point format in the rendering data from model space to clip space to generate transformed vertices, culling a transformed vertex of the transformed vertices prior to processing by a lighting module after determining that the transformed

vertex is not needed, and lighting each of the transformed vertices using the lighting module, except for the culled transformed vertex, to compute color and generate transformed and lighted vertices from the rendering data.

Claim 11 recites "converting the vertices in the floating-point format into a normalized homogeneous coordinate system (NHCS) fixed-point format. This is in contrast to a floating-point format. More specifically, a floating-point format is a real number representation that can contain a fractional part. The decimal point is "floating" because there is no fixed number of digits before and after the decimal point. Since computers are integer machines, they can only represent real numbers using complex codes, such as the IEEE Floating-Point Standard.

A fixed-point format fixes the number of digits before and after the decimal point. Fixed-point format represents a floating-point number in an integer format with an imaginary decimal point dividing the integer and fractional parts. Bits to the right of the imaginary decimal point represent the fractional part of the number being represented. These bits to the right use the negative powers of 2. Bits to the left of the imaginary decimal point represent the integer portion of the number being represented, and these bits use the positive powers of 2.

"In general, the task module 140 inputs the floating-point data 310 and converts the data 310 into a fixed-point format or a NHCS fixed-point format" (specification, page 15, lines 8-10). "In some embodiments, the task module 140 is capable of converting the data 120 in a floating-point format into either a traditional fixed-point format **or** a preferred NHCS fixed-point format" (specification, page 8, lines 1-3; emphasis added). Thus, the NHCS fixed-point format is **different** from a traditional fixed-point format. More specifically, the NHCS fixed-point format "is a high-resolution variation of fixed-point number representation" (specification, page 21, lines 14-16).

"NHCS is a type of vertex representation. NHCS can eliminate the annoying overflow, and provides a wider data space. For example, without NHCS, the model

space vertex coordinates range from $2^{-16} \sim 2^{15}$, assuming that a 16-bit mantissa is used. On the other hand, if NHCS is used, the model space vertex coordinates range from $2^{-31} \sim 2^{31}$. By adopting NHCS it can be seen that both range and precision are greatly increased" (specification, page 22, lines 20-25).

Three-dimensional (3D) points (such as vertices) in computer graphics can be represented using a 4-vector coordinate system, known as a homogenous coordinate system. A point in the homogeneous coordinate system is represented by four terms: (x,y,z,w). Thus, to map an arbitrary point (x,y,z,w) in the homogeneous coordinate system back to a 3D point, the first three terms are divided by the fourth term (w). In other words, the 3D point is $(x/w,\ y/w,\ z/w)$.

"NHCS also makes the conversion from floating-point to fixed-point easy. It is not necessary to know the exact range of the input vertices. NHCS also eliminates the factitious overflow and takes advantage of the full storage of the buffer. Moreover, NHCS has the advantage of providing a wider data representation given the same precision. NHCS also preserves all transform and lighting operations and makes use of the "w" in homogeneous coordinate representation" (specification, page 22, lines 26-30 to page 23, lines 1-2).

In contrast, Narayanaswami merely discloses an optimization of vertex processing using a special CPU instruction. However, Narayanaswami nowhere discloses the feature recited in Applicants' amended claim 11 of "converting the vertices in the floating-point format into a normalized homogeneous coordinate system (NHCS) fixed-point format". The Applicants, therefore, respectfully traverse this rejection of amended independent claim 11 because Narayanaswami does not teach, either explicitly or implicitly, the material claimed feature recited in claim 11 of "converting the vertices in the floating-point format into a normalized homogeneous coordinate system (NHCS) fixed-point format".

Because the Applicants' claim 11 recites at least one feature that is neither explicitly disclosed nor suggested by Narayanaswami, the Applicants respectfully submit that the rejection of amended independent claim 11 under 35 U.S.C. § 102(b) as being anticipated by Narayanaswami has been overcome. Moreover, rejected claims 12 and 19 depend from amended independent claim 11 and are therefore also novel over Narayanaswami (MPEP § 2143.03). The Applicants, therefore, respectfully request reexamination, reconsideration and withdrawal of the rejection of claims 11, 12, and 19 under 35 U.S.C. § 102(b) as being anticipated by Narayanaswami based on the amendments to independent claim 11 and the arguments above and below.

Section 103(a) Rejections

The Office Action rejected claims 1-5 and 10 under 35 U.S.C. § 103(a) as being unpatentable over Zatz et al. (U.S. Patent No. 6,724,394) in view of Morgan et al. (U.S. Patent No. 5,821,940). The Office Action contended that the combination of Zatz et al. and Morgan et al. teach all the elements of the Applicants' claimed invention.

In response, the Applicants respectfully traverse these rejections. In general, the Applicants submit that the combination of Zatz et al. and Morgan et al. is lacking at least one element of the Applicants' claimed invention. More specifically, neither Zatz et al. nor Morgan et al. disclose, either explicitly or implicitly, the material claimed feature of:

1.   **(Regarding amended independent claim 1)**: "converting the vertices in a floating-point format into a normalized homogeneous coordinate system (NHCS) fixed-point format by performing lighting and texture generation and transformation to obtain NHCS fixed-point format vertices".

Further, the combination fails to appreciate the advantages of this claimed feature. In addition, there is no technical suggestion or motivation disclosed in either Zatz et al. or Morgan et al. to define this claimed feature. Thus, the Applicants submit that the combination of Zatz et al. and Morgan et al. cannot make obvious the Applicants' claimed feature listed above.

To make a prima facie showing of obviousness, all of the claimed features of an Applicant's invention must be considered, especially when they are <u>missing</u> from the prior art. If a claimed feature is <u>not disclosed</u> in the prior art and has <u>advantages not appreciated</u> by the prior art, then no prima facie showing of obviousness has been made. The Federal Circuit Court has held that it was an error not to distinguish claims over a combination of prior art references where a material limitation in the claimed system and its purpose was not taught therein. *In re Fine,* 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). Moreover, as stated in the MPEP, if a prior art reference does not <u>disclose, suggest </u>or provide any <u>motivation</u> for at least one claimed feature of an Applicant's invention, then a prima facie case of obviousness has not been established (MPEP § 2142).

<u>Amended Independent Claim 1</u>

Amended independent claim 1 of the Applicants claimed invention includes a computer-implemented method for processing rendering data containing vertices. The method includes defining a vertex cache as a software cache located within a transform and lighting module and containing vertices in a floating-point format, determining that a first vertex of the rendering data has already been transformed but not lighted and storing the first vertex in the vertex cache such that the first vertex bypasses a transformation module of the transform and lighting module, and <u>converting the vertices</u> in a floating-point format <u>into a normalized homogeneous coordinate system (NHCS) fixed-point format</u> by performing lighting and texture generation and transformation to obtain NHCS fixed-point format vertices. The method also includes performing view frustum clipping on the NHCS fixed-point format vertices after the lighting and texture generation and transformation, transforming vertices of the rendering data that have not already been transformed from model space into clip space, and continuing to store vertices of the rendering data that have already been transformed but not lighted in the vertex cache as needed to facilitate a single streamline branched architecture that avoids processing duplication of the vertices.

As noted in the Office Action, both Zatz et al. and Morgan et al. "fail to explicitly teach the use of fixed-point vertices." Moreover, the combination of Zatz et al. and Morgan et al. also fails to appreciate or recognize the advantages of the Applicants' claimed feature recited in claim 1 of "converting the vertices in a floating-point format into a normalized homogeneous coordinate system (NHCS) fixed-point format by performing lighting and texture generation and transformation to obtain NHCS fixed-point format vertices". More specifically, this claimed feature makes the conversion as "easy as possible (so that the range of the input vertices does not need to be known) while preserving the precision of the data. NHCS fixed-point number representation achieves these objectives" (specification, page 22, lines 16-19). In addition, this feature "makes the conversion from floating-point to fixed-point easy. It is not necessary to know the exact range of the input vertices. NHCS also eliminates the factitious overflow and takes advantage of the full storage of the buffer. Moreover, NHCS has the advantage of providing a wider data representation given the same precision. NHCS also preserves all transform and lighting operations and makes use of the "w" in homogeneous coordinate representation" (specification, page 22, lines 26-30 to page 23, lines 1-2). Neither Zatz et al. nor Morgan et al. discuss or appreciate these advantages of this feature recited in Applicants' claim 1.

The Applicant, therefore, submits that obviousness cannot be established since the combination of Zatz et al. and Morgan et al. fails to teach, disclose, suggest or provide any motivation for the Applicants' claimed feature recited in claim 1 of "converting the vertices in a floating-point format into a normalized homogeneous coordinate system (NHCS) fixed-point format by performing lighting and texture generation and transformation to obtain NHCS fixed-point format vertices." In addition to explicitly lacking this feature, both Zatz et al. and Morgan et al. fail to implicitly disclose, suggest, or provide motivation for this feature. Further, the combination fails to appreciate advantages of this claimed feature recited in amended claim 1.

Therefore, as set forth in *In re Fine* and MPEP § 2142, the combination of Zatz et al. and Morgan et al. cannot render the Applicants' claimed invention recited in claim 1

obvious because Zatz et al. and Morgan et al. are missing at least one material feature recited in Applicants' claim 1, as discussed above. Consequently, because a prima facie case of obviousness cannot be established due to the lack of "some teaching, suggestion, or incentive supporting the combination", the rejection must be withdrawn. ACS Hospital Systems, Inc. v. Montefiore Hospital, 732 F.2d 1572, 1577, 221 USPQ 929, 933 (Fed. Cir. 1984); MPEP 2143.01.

Accordingly, the Applicants respectfully submit that amended independent claim 1 is patentable under 35 U.S.C. § 103(a) over Zatz et al. in view of Morgan et al. based on the amendments to claim 1, and the legal and technical arguments set forth above and below. Moreover, claims 2-5 and 10 depend from amended independent claim 1, and are also nonobvious over Zatz et al. in view of Morgan et al. (MPEP § 2143.03). The Applicants, therefore, respectfully requests reexamination, reconsideration and withdrawal of the rejection of claims 1-5 and 10 under 35 U.S.C. § 103(a) as being unpatentable over Zatz et al. in view of Morgan et al.

The Office Action rejected claims 6 and 7 under 35 U.S.C. § 103(a) as being unpatentable over Zatz et al. and Morgan et al. in view of a book by Foley et al. entitled "Computer Graphics: Principles and Practice".   The Office Action contended that the combination of Zatz et al., Morgan et al., and Foley et al. teach all the elements of the Applicants' claimed invention.

In response, the Applicants respectfully traverse these rejections. In general, the Applicants submit that the combination of Zatz et al., Morgan et al., and Foley et al. is lacking at least one element of the Applicants' claimed invention. More specifically, neither Zatz et al., Morgan et al., nor Foley et al. disclose, either explicitly or implicitly, the material claimed feature of:

1.   (**Regarding amended independent claim 1**): "converting the vertices in a floating-point format into a normalized homogeneous coordinate system (NHCS) fixed-point format by performing lighting and texture generation and transformation to obtain NHCS fixed-point format vertices".

Further, the combination fails to appreciate the advantages of this claimed feature. In addition, there is no technical suggestion or motivation disclosed in either Zatz et al., Morgan et al., or Foley et al to define this claimed feature. Thus, the Applicants submit that the combination of Zatz et al., Morgan et al., and Foley et al. cannot make obvious the Applicants' claimed feature listed above.

Amended Independent Claim 1

As mentioned above, amended independent claim 1 recites "converting the vertices in a floating-point format into a normalized homogeneous coordinate system (NHCS) fixed-point format by performing lighting and texture generation and transformation to obtain NHCS fixed-point format vertices". As also stated above, the Office Action stated that both Zatz et al. and Morgan et al. "fail to explicitly teach the use of fixed-point vertices."

Foley et al. add nothing to the cited combination that would render Applicants' claim 1 obvious. Specifically, the Office Action also stated that Foley et al. fails to ""explicitly teach the use of fixed-point vertices."

The combination of Zatz et al., Morgan et al., and Foley et al. also fails to appreciate or recognize the advantages of the Applicants' claimed feature recited in claim 1, as discussed above.

The Applicant, therefore, submits that obviousness cannot be established since the combination of Zatz et al., Morgan et al., and Foley et al. fails to teach, disclose, suggest or provide any motivation for the Applicants' claimed feature recited in claim 1 of "converting the vertices in a floating-point format into a normalized homogeneous

coordinate system (NHCS) fixed-point format by performing lighting and texture generation and transformation to obtain NHCS fixed-point format vertices". In addition to explicitly lacking this feature, Zatz et al., Morgan et al., and Foley et al. fail to implicitly disclose, suggest, or provide motivation for this feature. Further, the combination fails to appreciate advantages of this claimed feature recited in claim 1.

Therefore, as set forth in *In re Fine* and MPEP § 2142, the combination of Zatz et al., Morgan et al., and Foley et al. cannot render the Applicants' claimed invention recited in claim 1 obvious because Zatz et al., Morgan et al., and Foley et al. are missing at least one material feature recited in Applicants' claim 1, as discussed above. Consequently, because a prima facie case of obviousness cannot be established due to the lack of "some teaching, suggestion, or incentive supporting the combination", the rejection must be withdrawn. ACS Hospital Systems, Inc. v. Montefiore Hospital, 732 F.2d 1572, 1577, 221 USPQ 929, 933 (Fed. Cir. 1984); MPEP 2143.01.

Accordingly, the Applicants respectfully submit that amended independent claim 1 is patentable under 35 U.S.C. § 103(a) over Zatz et al. and Morgan et al. in view of Foley et al. based on the amendments to claim 1, and the legal and technical arguments set forth above and below. Moreover, claims 6 and 7 depend from amended independent claim 1, and are also nonobvious over Zatz et al. and Morgan et al. in view of Foley et al. (MPEP § 2143.03). The Applicants, therefore, respectfully requests reexamination, reconsideration and withdrawal of the rejection of claims 6 and 7 under 35 U.S.C. § 103(a) as being unpatentable over Zatz et al. and Morgan et al. in view of Foley et al.

The Office Action rejected claim 8 under 35 U.S.C. § 103(a) as being unpatentable over Zatz et al. and Morgan et al. in view of Wang et al. (U.S. Patent No. 7,139,005). The Office Action contended that the combination of Zatz et al., Morgan et al., and Wang et al. teach all the elements of the Applicants' claimed invention.

In response, the Applicants respectfully traverse these rejections. In general, the Applicants submit that the combination of Zatz et al., Morgan et al., and Wang et al. is lacking at least one element of the Applicants' claimed invention. More specifically, neither Zatz et al., Morgan et al., nor Wang et al. disclose, either explicitly or implicitly, the material claimed feature of:

1.   **(Regarding amended independent claim 1)**: "converting the vertices in a floating-point format into a normalized homogeneous coordinate system (NHCS) fixed-point format by performing lighting and texture generation and transformation to obtain NHCS fixed-point format vertices".

Further, the combination fails to appreciate the advantages of this claimed feature. In addition, there is no technical suggestion or motivation disclosed in either Zatz et al., Morgan et al., or Wang et al to define this claimed feature. Thus, the Applicants submit that the combination of Zatz et al., Morgan et al., and Wang et al. cannot make obvious the Applicants' claimed feature listed above.

Amended Independent Claim 1

As mentioned above, amended independent claim 11 recites "converting the vertices in a floating-point format into a normalized homogeneous coordinate system (NHCS) fixed-point format by performing lighting and texture generation and transformation to obtain NHCS fixed-point format vertices". As also stated above, the Office Action stated that both Zatz et al. and Morgan et al. "fail to explicitly teach the use of fixed-point vertices."

Moreover, the Applicants submit that the Wang et al. patent is not a reference under Section 103(a). In particular, Section 103(a) states that a "patent may not be obtained thought the invention is not identically disclosed or described as set forth in section 102 of this title". Wang et al. is not reference under Section 102(a) because this section requires that an act take place "before the invention thereof by the applicant." The Applicants cannot be responsible for acts that are supposed to be anticipatory prior art at

the time before the Applicants' invention was made because the Applicants could not have known of the invention until they invented it. Thus, Wang et al. is not a reference under Section 102(a).

Wang et al. also is not reference under Section 102(b), because the effective date of Wang et al. is not "more than one year prior to the date of the application for patent in the United States". Thus, Wang et al. is not a reference under Section 102(b).

Wang et al. also is not reference under Section 102(e), because this section requires that the invention be "by another." In this case, both the Wang et al. patent and the Applicants' invention share the same inventors. Thus, Wang et al. is not "by another", and is not a reference under Section 102(a).

Wang et al. is not a reference under any other part of Section 102. Therefore, the Applicants submit that Wang et al. is not a reference under Section 103(a).

Since Wang et al. is not a reference, that leaves combination of Zatz et al. and Morgan et al. as discussed above, both of these documents fail to appreciate or recognize the advantages of the Applicants' claimed feature recited in claim 1.

The Applicant, therefore, submits that obviousness cannot be established since the combination of Zatz et al. and Morgan et al. fails to teach, disclose, suggest or provide any motivation for the Applicants' claimed feature recited in claim 1 of "converting the vertices in a floating-point format into a normalized homogeneous coordinate system (NHCS) fixed-point format by performing lighting and texture generation and transformation to obtain NHCS fixed-point format vertices". Further, Wang et al. is not a reference. Moreover, Zatz et al. and Morgan et al. fail to implicitly disclose, suggest, or provide motivation for this feature. Further, the combination fails to appreciate advantages of this claimed feature recited in claim 1.

Therefore, as set forth in *In re Fine* and MPEP § 2142, the combination of Zatz et al., Morgan et al., and Wang et al. cannot render the Applicants' claimed invention recited in claim 1 obvious because Zatz et al. and Morgan et al., are missing at least one material feature recited in Applicants' claim 1 and Wang et al. is not reference, as discussed above. Consequently, because a prima facie case of obviousness cannot be established due to the lack of "some teaching, suggestion, or incentive supporting the combination", the rejection must be withdrawn. ACS Hospital Systems, Inc. v. Montefiore Hospital, 732 F.2d 1572, 1577, 221 USPQ 929, 933 (Fed. Cir. 1984); MPEP 2143.01.

Accordingly, the Applicants respectfully submit that amended independent claim 1 is patentable under 35 U.S.C. § 103(a) over Zatz et al. and Morgan et al. in view of Wang et al. based on the amendments to claim 1, and the legal and technical arguments set forth above and below. Moreover, claim 8 depends from amended independent claim 1, and are also nonobvious over Zatz et al. and Morgan et al. in view of Wang et al. (MPEP § 2143.03). The Applicants, therefore, respectfully requests reexamination, reconsideration and withdrawal of the rejection of claim 8 under 35 U.S.C. § 103(a) as being unpatentable over Zatz et al. and Morgan et al. in view of Wang et al.

The Office Action rejected claims 13, 14, 16, and 17 under 35 U.S.C. § 103(a) as being unpatentable over Narayanaswami et al. as applied to claims 11, 12, and 18, in view of Foley et al. The Office Action contended that the combination of Narayanaswami et al. and Foley et al. teach all the elements of the Applicants' claimed invention.

In response, the Applicants respectfully traverse these rejections. In general, the Applicants submit that the combination of Narayanaswami et al. and Foley et al. is lacking at least one element of the Applicants' claimed invention. More specifically, neither Narayanaswami et al. nor Foley et al. disclose, either explicitly or implicitly, the material claimed feature of:

1.   (**Regarding amended independent claim 11**): "<u>converting the vertices</u> in the floating-point format <u>into a normalized homogeneous coordinate system (NHCS) fixed-point format</u>".

Further, the combination fails to appreciate the advantages of this claimed feature. In addition, there is no technical suggestion or motivation disclosed in either Narayanaswami et al. or Foley et al. to define this claimed feature. Thus, the Applicants submit that the combination of Narayanaswami et al. and Foley et al. cannot make obvious the Applicants' claimed feature listed above.

Amended Independent Claim 11

As mentioned above, amended independent claim 11 "<u>converting the vertices</u> in the floating-point format <u>into a normalized homogeneous coordinate system (NHCS)</u> <u>fixed-point format</u>". As also stated above, Narayanaswami et al. nowhere discloses the feature recited in Applicants' amended claim 11. Moreover, as mentioned above, the Office Action also stated that Foley et al. fails to ""explicitly teach the use of fixed-point vertices."

The combination of Narayanaswami et al. and Foley et al. also fails to appreciate or recognize the advantages of the Applicants' claimed feature recited in claim 11, as discussed above.

The Applicant, therefore, submits that obviousness cannot be established since the combination of Narayanaswami et al. and Foley et al. fails to teach, disclose, suggest or provide any motivation for the Applicants' claimed feature recited in claim 11 of "converting the vertices in the floating-point format into a normalized homogeneous coordinate system (NHCS) fixed-point format". In addition to explicitly lacking this feature, both Narayanaswami et al. and Foley et al. fail to implicitly disclose, suggest, or provide motivation for this feature. Further, the combination fails to appreciate advantages of this claimed feature recited in amended claim 11.

Therefore, as set forth in *In re Fine* and MPEP § 2142, the combination of Narayanaswami et al. and Foley et al. cannot render the Applicants' claimed invention recited in claim 11 obvious because Narayanaswami et al. and Foley et al. are missing at least one material feature recited in Applicants' claim 11, as discussed above. Consequently, because a prima facie case of obviousness cannot be established due to the lack of "some teaching, suggestion, or incentive supporting the combination", the rejection must be withdrawn. ACS Hospital Systems, Inc. v. Montefiore Hospital, 732 F.2d 1572, 1577, 221 USPQ 929, 933 (Fed. Cir. 1984); MPEP 2143.01.

Accordingly, the Applicants respectfully submit that amended independent claim 11 is patentable under 35 U.S.C. § 103(a) over Narayanaswami et al. as applied to claims 11, 12, and 18, in view of Foley et al. based on the amendments to claim 11, and the legal and technical arguments set forth above and below. Moreover, claims 13, 14, 16, and 17 depend from amended independent claim 11, and are also nonobvious over Narayanaswami et al. and Foley et al. (MPEP § 2143.03). The Applicants, therefore, respectfully requests reexamination, reconsideration and withdrawal of the rejection of claims 13, 14, 16, and 17 under 35 U.S.C. § 103(a) as being unpatentable over Narayanaswami et al. as applied to claims 11, 12, and 18, in view of Foley et al.

The Office Action rejected claims 20-26 under 35 U.S.C. § 103(a) as being unpatentable over Zatz et al. in view of Morgan et al. in view of Foley et al. and further in view of Kaufman et al. (U. S. Patent No. 4,987,554). The Office Action contended that the combination of Zatz et al., Morgan et al., Foley et al., and Kaufman et al. teaches all the elements of the Applicants' claimed invention.

In response, the Applicants respectfully traverse these rejections. In general, the Applicants submit that the combination of Zatz et al., Morgan et al., Foley et al., and Kaufman et al. is lacking at least one element of the Applicants' claimed invention. More

specifically, neither Zatz et al., Morgan et al., Foley et al., nor Kaufman et al. disclose, either explicitly or implicitly, the material claimed feature of:

      1.   **(Regarding amended independent claim 20)**: "converting the 3D data in a floating-point format into a normalized homogenous coordinate system (NHCS) fixed-point format in clip space to obtain NHCS fixed-point format vertices."

Further, the combination fails to appreciate the advantages of this claimed feature. In addition, there is no technical suggestion or motivation disclosed in either Zatz et al., Morgan et al., Foley et al., or Kaufman et al. to define this claimed feature. Thus, the Applicants submit that the combination of Zatz et al., Morgan et al., Foley et al., and Kaufman et al. cannot make obvious the Applicants' claimed feature listed above.

Amended Independent Claim 20

Amended independent claim 20 of the Applicants claimed invention includes a computer-implemented process stored and encoded on a computer-readable storage medium for rendering graphics on an embedded device. The process includes inputting 3D data containing vertices in model space in a floating-point format, and converting the 3D data in a floating-point format into a normalized homogenous coordinate system (NHCS) fixed-point format in clip space to obtain NHCS fixed-point format vertices. The process further includes generating coordinates for the NHCS fixed-point format vertices by performing lighting and texture generation and transformation, examining each of the NHCS fixed-point format vertices before lighting to determine whether to cull the NHCS fixed-point format vertices, storing the NHCS fixed-point format vertices as needed in a vertex cache to provide a single streamline branched architecture that avoids processing duplication of the NHCS fixed-point format vertices, and performing view frustum clipping of the NHCS fixed-point format vertices to generate an output of 2D screen coordinates to render the graphics represented by the rendering data on the embedded device.

As mentioned above, with regard to amended independent claims 1 and 11, amended independent claim 20 includes the feature of "converting the 3D data in a floating-point format into a normalized homogenous coordinate system (NHCS) fixed-point format in clip space to obtain NHCS fixed-point format vertices." As also noted above, the Office Action stated that Zatz et al., Morgan et al. and Foley et al. "fail to explicitly teach the use of fixed-point vertices.

The Office Action stated that Kaufman et al. disclose the use of fixed-point vertices at column 20, lines 36-40). However, Kaufman et al. merely disclose the use of traditional fixed-point vertices. As noted above, the NHCS fixed-point format is **different** from a traditional fixed-point format. More specifically, the NHCS fixed-point format "is a high-resolution variation of fixed-point number representation" (specification, page 21, lines 14-16). Nowhere do Kaufman et al. disclose converting from a floating-point format to a NHCS fixed-point format.

Moreover, the combination of Zatz et al., Morgan et al., Foley et al., and Kaufman et al. also fails to appreciate or recognize the advantages of the Applicants' claimed feature recited in claim 20 of "converting the 3D data in a floating-point format into a normalized homogenous coordinate system (NHCS) fixed-point format in clip space to obtain NHCS fixed-point format vertices." More specifically, this claimed feature makes the conversion as "easy as possible (so that the range of the input vertices does not need to be known) while preserving the precision of the data. NHCS fixed-point number representation achieves these objectives" (specification, page 22, lines 16-19). In addition, this feature "makes the conversion from floating-point to fixed-point easy. It is not necessary to know the exact range of the input vertices. NHCS also eliminates the factitious overflow and takes advantage of the full storage of the buffer. Moreover, NHCS has the advantage of providing a wider data representation given the same precision. NHCS also preserves all transform and lighting operations and makes use of the "w" in homogeneous coordinate representation" (specification, page 22, lines 26-30 to page 23, lines 1-2). Neither Zatz et al., Morgan et al., Foley et al., nor Kaufman et al. discuss or appreciate these advantages of this feature recited in Applicants' claim 20.

The Applicants, therefore, submit that obviousness cannot be established since the combination of Zatz et al., Morgan et al., Foley et al., and Kaufman et al. fails to teach, disclose, suggest or provide any motivation for the Applicants' claimed feature recited in claim 20 of "converting the 3D data in a floating-point format into a normalized homogenous coordinate system (NHCS) fixed-point format in clip space to obtain NHCS fixed-point format vertices." In addition to explicitly lacking this feature, Zatz et al., Morgan et al., Foley et al., and Kaufman et al. fail to implicitly disclose, suggest, or provide motivation for this feature. Further, the combination fails to appreciate advantages of this claimed feature recited in amended claim 20.

Therefore, as set forth in *In re Fine* and MPEP § 2142, the combination of Zatz et al., Morgan et al., Foley et al., and Kaufman et al. cannot render the Applicants' claimed invention recited in claim 20 obvious because Zatz et al., Morgan et al., Foley et al., and Kaufman et al. are missing at least one material feature recited in Applicants' claim 20, as discussed above. Consequently, because a prima facie case of obviousness cannot be established due to the lack of "some teaching, suggestion, or incentive supporting the combination", the rejection must be withdrawn. ACS Hospital Systems, Inc. v. Montefiore Hospital, 732 F.2d 1572, 1577, 221 USPQ 929, 933 (Fed. Cir. 1984); MPEP 2143.01.

Accordingly, the Applicants respectfully submit that amended independent claim 20 is patentable under 35 U.S.C. § 103(a) over Zatz et al. in view of Morgan et al. in view of Foley et al. and further in view of Kaufman et al. based on the amendments to claim 20, and the legal and technical arguments set forth above and below. Moreover, claims 21-26 depend from amended independent claim 20, and are also nonobvious over Zatz et al., Morgan et al., Foley et al., and Kaufman et al. (MPEP § 2143.03). The Applicants, therefore, respectfully requests reexamination, reconsideration and withdrawal of the rejection of claims 20-26 under 35 U.S.C. § 103(a) as being unpatentable over Zatz et al. in view of Morgan et al. in view of Foley et al. and further in view of Kaufman et al.

The Office Action rejected claims 28 and 30 under 35 U.S.C. § 103(a) as being unpatentable over Zatz et al. in view of Morgan et al. in view of Foley et al. in view of Kaufman et al. and further in view of Narayanaswami. The Office Action contended that the combination of Zatz et al., Morgan et al., Foley et al., Kaufman et al., and Narayanaswami teaches all the elements of the Applicants' claimed invention.

In response, the Applicants respectfully traverse these rejections. In general, the Applicants submit that the combination of Zatz et al., Morgan et al., Foley et al., Kaufman et al., and Narayanaswami is lacking at least one element of the Applicants' claimed invention. More specifically, neither Zatz et al., Morgan et al., Foley et al., Kaufman et al., nor Narayanaswami disclose, either explicitly or implicitly, the material claimed feature of:

1. **(Regarding amended independent claim 28)**: "a transformation module that <u>converts vertices</u> in a floating-point format in the rendering data <u>into a normalized homogenous coordinate system (NHCS) fixed-point format</u> in clip space to generate transformed vertices".

Further, the combination fails to appreciate the advantages of this claimed feature. In addition, there is no technical suggestion or motivation disclosed in either Zatz et al., Morgan et al., Foley et al., Kaufman et al., or Narayanaswami to define this claimed feature. Thus, the Applicants submit that the combination of Zatz et al., Morgan et al., Foley et al., Kaufman et al., and Narayanaswami cannot make obvious the Applicants' claimed feature listed above.

<u>Amended Independent Claim 28</u>

Amended independent claim 28 of the Applicants claimed invention includes a transform and lighting module for preparing rendering data in a floating-point format for rendering. The module includes an embedded computing device, and a computer-readable storage medium having stored and encoded thereon a computer program

having program modules containing computer-executable instructions that are executable by the embedded computing device. The computer program includes a transformation module that <u>converts vertices</u> in a floating-point format in the rendering data <u>into a normalized homogenous coordinate system (NHCS) fixed-point format</u> in clip space to generate transformed vertices, a vertex cache implemented as a software cache and located within the transform and lighting module that stores a first vertex contained in the rendering data such that the first vertex has previously been transformed but has not previously been lighted such that the first vertex is not processed by the transformation module, and a lighting module that computes color for each of the transformed vertices. The computer program also includes a culling module positioned after the transformation module and before the lighting module that culled a second vertex from the transformed vertices prior to processing by the lighting module after determining that the second vertex was not needed such that the second vertex is not processed by the lighting module, a texture generation and texture transformation module that computes texture coordinates and transforms the texture coordinates into a fixed-point format in a normalized homogenous coordinate system (NHCS) to obtain NHCS fixed-point format vertices in clip space, and a view frustum module positioned after the lighting module and after the texture generation and transformation module that performs view frustum clipping of the NHCS fixed-point format vertices in clip space to generate output data that can be rendered for display on a display device of the embedded computing device.

As mentioned above, with regard to amended independent claims 1, 11, and 20, amended independent claim 28 includes the feature of "a transformation module that <u>converts vertices</u> in a floating-point format in the rendering data <u>into a normalized homogenous coordinate system (NHCS) fixed-point format</u> in clip space to generate transformed vertices". As also noted above, the Office Action stated that Zatz et al., Morgan et al. and Foley et al. "fail to explicitly teach the use of fixed-point vertices. As noted above, Narayanaswami merely discloses an optimization of vertex processing using a special CPU instruction, but nowhere discloses the feature recited in Applicants'

amended 28. In addition, as discussed above, Kaufman et al. merely teach the use of a traditional fixed-point format, not a NHCS fixed-point format.

The combination of Zatz et al., Morgan et al., Foley et al., Kaufman et al., and Narayanaswami also fails to appreciate or recognize the advantages of the Applicants' claimed feature recited in claim 28, as discussed above.

The Applicants, therefore, submit that obviousness cannot be established since the combination of Zatz et al., Morgan et al., Foley et al., Kaufman et al., and Narayanaswami fails to teach, disclose, suggest or provide any motivation for the Applicants' claimed feature recited in claim 28 of "a transformation module that converts vertices in a floating-point format in the rendering data into a normalized homogenous coordinate system (NHCS) fixed-point format in clip space to generate transformed vertices". In addition to explicitly lacking this feature, Zatz et al., Morgan et al., Foley et al., Kaufman et al., and Narayanaswami fail to implicitly disclose, suggest, or provide motivation for this feature. Further, the combination fails to appreciate advantages of this claimed feature recited in amended claim 28.

Therefore, as set forth in *In re Fine* and MPEP § 2142, the combination of Zatz et al., Morgan et al., Foley et al., Kaufman et al., and Narayanaswami cannot render the Applicants' claimed invention recited in claim 28 obvious because Zatz et al., Morgan et al., Foley et al., Kaufman et al., and Narayanaswami are missing at least one material feature recited in Applicants' claim 28, as discussed above. Consequently, because a prima facie case of obviousness cannot be established due to the lack of "some teaching, suggestion, or incentive supporting the combination", the rejection must be withdrawn. ACS Hospital Systems, Inc. v. Montefiore Hospital, 732 F.2d 1572, 1577, 221 USPQ 929, 933 (Fed. Cir. 1984); MPEP 2143.01.

Accordingly, the Applicants respectfully submit that amended independent claim 28 is patentable under 35 U.S.C. § 103(a) over Zatz et al. in view of Morgan et al. in view of Foley et al. in view of Kaufman et al. and further in view of Narayanaswami based on the
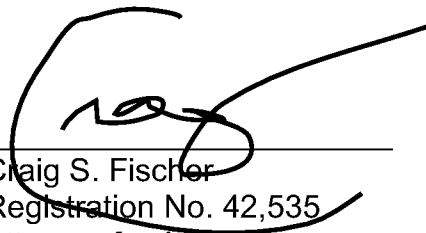
amendments to claim 28, and the legal and technical arguments set forth above and below. Moreover, claim 30 depends from amended independent claim 28, and is also nonobvious over of Zatz et al., Morgan et al., Foley et al., Kaufman et al., and Narayanaswami (MPEP § 2143.03). The Applicants, therefore, respectfully requests reexamination, reconsideration and withdrawal of the rejection of claims 28 and 30 under 35 U.S.C. § 103(a) as being unpatentable over Zatz et al. in view of Morgan et al. in view of Foley et al. in view of Kaufman et al. and further in view of Narayanaswami.

<div align="center">Conclusion</div>

In view of the amendments to claims 1, 10, 11, 19, 20, and 28, the cancellation of claims 5-7, 9, 15, 18, 27, 29, and 31, and the arguments set forth above, the Applicants submit that pending claims 1-4, 8, 10-14, 16, 17, 19-26, 28, and 30 are in condition for immediate allowance. The Examiner, therefore, is respectfully requested to withdraw the outstanding rejections of the claims and to pass each of the pending claims of this application to issue.

In an effort to expedite and further the prosecution of the subject application, the Applicants kindly invite the Examiner to telephone the Applicants' attorney at (805) 278-8855 if the Examiner has any comments, questions or concerns, wishes to discuss any aspect of the prosecution of this application, or desires any degree of clarification of this response.

Respectfully submitted,
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